Appendix Q—Water Treatment Requirements

Summary Evaluation for Each Water-Supply Well

Following is an evaluation for potential water treatment for each water-supply well. The evaluations focus on applicable treatment technologies with limited consideration of practical issues such as equipment space requirements, freeze protection, wastewater disposal, or treatment equipment already in place, factors which would be subject to individual circumstances and preferences of the water-supply well owners.

The following table is a summary of the water treatment requirements for the water-supply wells.

Well ID	Ferrous Iron	pH	Turbidity	Iron	Manganese	Sodium	Chloride	Nitrate	Sulfate	TDS	Arsenic	Lithium	Thallium	Uranium and Gross Alpha	Radon-222	Radium, tot	Microorganisms	RO System in Place
PGDW05		X		X		X			X	X							X	
PGDW14			X			X			X	X			X	X	X		X	X
PGDW20		X				X			X	X							X	X
PGDW23		X				X			X	X					X		X	
PGDW30		X				X			X	X							X	
PGDW32		X				X			X	X					X		X	
PGDW33						X			X	X				X	X		X	
PGDW41A						X	X	X	X	X	X	X	X	X	X		X	
PGDW41B	X		X	X	X	X			X	X		X				X	X	
PGDW42	NA	NA	NA			X			X	NA		NA		NA	NA	NA	NA	

Note: Water from PGDW14 exceeds MCL for gross alpha but not uranium.

As each of the water-supply wells appears to have an issue with one or more microbiological constituents (coliform, iron bacteria, and/or sulfate bacteria), chlorination would be a consideration for each of the wells if shock treatment has been or is tried and found to be not sufficiently effective.

In addition, a common issue to all the water-supply wells is elevated sodium, which can be treated by ionic exchange (IX) or reverse osmosis (RO). The drawback for treating with IX is the strong acid necessary to regenerate the resin for sodium treatment and the drawback for RO is the relatively high water rejection (waste) rate.

PGDW05

Problematic Constituents: Elevated pH, Iron, Sodium, Sulfate, Total Dissolved Solids (TDS), Microorganisms

The pH greater than 9 requires acidulation which would be the first treatment step, followed by any chlorination treatment. Because of iron, water should be filtered (especially if chlorinated) before treatment of other constituents to prevent iron fouling of treatment equipment. The sodium, sulfate, and TDS can be treated using either IX or RO. IX treatment would require two different resins for the sodium and sulfate. The strong acid regeneration solution required for IX sodium treatment could also be used for acidulation.

PGDW14

Problematic Constituents: Turbidity, Sodium, Sulfate, TDS, Thallium, Uranium, Radon-222, Microorganisms

Filtration is necessary for the turbidity. The sodium, sulfate, TDS, thallium, and uranium can be treated using either IX or RO. IX treatment would require one resin for the sodium and at least one other resin type for the sulfate and uranium. The elevated TDS would require relatively frequent IX regeneration and would correlate to a relatively high water rejection rate for RO. Although more complicated and costly, an optimized combination of IX (including conventional water softening) and RO could reduce the water waste. Radon-222 could be treated by aeration or carbon adsorption.

PGDW20

Problematic Constituents: Elevated pH, Sodium, Sulfate, TDS, Microorganisms

The pH greater than 9 requires acidulation. The sodium, sulfate, and TDS can be treated using either IX or RO. IX treatment would require two different resins for the sodium and sulfate. The elevated TDS would require relatively frequent IX regeneration and would correlate to a relatively high water rejection rate for RO. Although more complicated and costly, an optimized combination of IX (including conventional water softening) and RO could reduce the water waste. The strong acid regeneration solution required for IX sodium treatment could also be used for acidulation.

PGDW23

Problematic Constituents: Elevated pH, Sodium, Sulfate, TDS, Radon-222, Microorganisms

The pH greater than 9 requires acidulation. The sodium, sulfate, and TDS can be treated using either IX or RO. IX treatment would require two different resins for the sodium and sulfate. The strong acid regeneration solution required for IX sodium treatment could also be used for acidulation. Radon-222 could be treated by aeration or carbon adsorption.

PGDW30

Problematic Constituents: Elevated pH, Sodium, Sulfate, TDS, Microorganisms

The pH greater than 9 requires acidulation. The sodium, sulfate, and TDS can be treated using either IX or RO. IX treatment would require two different resins for the sodium and sulfate. The strong acid regeneration solution required for IX sodium treatment could also be used for acidulation.

PGDW32

Problematic Constituents: Elevated pH, Sodium, Sulfate, TDS, Radon-222, Microorganisms

The pH greater than 9 requires acidulation. The sodium, sulfate, and TDS can be treated using either IX or RO. IX treatment would require two different resins for the sodium and sulfate. The strong acid regeneration solution required for IX sodium treatment could also be used for acidulation. Radon-222 could be treated by aeration or carbon adsorption.

PGDW33

Problematic Constituents: Sodium, Sulfate, TDS, Uranium, Radon-222, Microorganisms

The sodium, sulfate, TDS, and uranium can be treated using either IX or RO. IX treatment would require one resin for the sodium and at least one other resin type for the sulfate and uranium. The elevated TDS would require relatively frequent IX regeneration and would correlate to a relatively high water rejection rate for RO. Although more complicated and costly, an optimized combination of IX (including conventional water softening) and RO could reduce the water waste. Radon-222 could be treated by aeration or carbon adsorption.

PGDW41A

Problematic Constituents: Sodium, Chloride, Nitrate, Sulfate, TDS, Arsenic, Lithium, Thallium, Uranium, Radon-222, Microorganisms

The sodium, chloride, nitrate, sulfate, TDS, arsenic, lithium, thallium, and uranium can be treated using either IX or RO. IX treatment would require at least two types of resin for the various anions, cations, and trace metals. The elevated TDS would require relatively frequent IX regeneration and would correlate to a relatively high water rejection rate for RO. Although more complicated and costly, an optimized combination of IX (including conventional water softening) and RO could reduce the water waste. IX would require both strong acid and strong caustic regeneration solutions for the different sodium and chloride treatment resins. Radon-222 could be treated by aeration or carbon adsorption.

PGDW41B

Problematic Constituents: Ferrous, Turbidity, Iron, Manganese, Sodium, Sulfate, TDS, Lithium, Radium, Microorganisms

Filtration is necessary for the turbidity, and would also remove some of the iron. The sodium, sulfate, TDS, lithium, and radium can be treated using either IX or RO. IX treatment would require at least two types of resin for the various anions, cations, and trace metals. The elevated TDS would require relatively frequent IX regeneration and would correlate to a relatively high water rejection rate for RO. Although more complicated and costly, an optimized combination of IX (including conventional water softening) and RO could reduce the water waste. IX or RO would also treat the ferrous iron and manganese, but greensand adsorption prior to IX or RO would increase efficiency of the latter treatment.

PGDW42

Problematic Constituents: Sodium, Sulfate

The sodium and sulfate can be treated using either IX or RO. IX treatment would require one resin for the sodium and another resin type for the sulfate.